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Are pension contributions a threat to shareholder payouts?

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Abstract

UK companies have been making large contributions to reduce the deficits of their pension funds, and are believed to fund such contributions in part by reducing dividends. Using data from 2003-16, we find little evidence that large deficit-reduction contributions are associated with reductions in regular dividends, though we find some restraint in dividend increases and total payout. Most companies make large contributions when they have healthy cash flows and strong profitability, or inflows from disposals of assets. This suggests that the Pensions Regulator allows companies flexibility regarding the timing of contributions.

1. Introduction

Until the 1990s, most large British companies provided their staff a defined-benefit (DB) pension scheme, in which pension benefits are underpinned by a contractual requirement for the employer to ensure that the scheme can meet its obligations. Since then, many companies and public-sector organisations have closed their DB schemes to new members, and many have frozen accrual of benefits for existing members.[2] One possible reason for the demise of DB schemes is a perceived threat to shareholder payouts.

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[2] The proportion of pension scheme members in fully open DB schemes declined from 66% in 2006 to 19% in 2016 (Pension Protection Fund, 2016).

A company whose pension fund is in deficit is required over time to inject sufficient funds to eliminate the deficit. Cutting the dividend is one way of releasing funds. On 29 October 2016 the *Financial Times* reported that 'investors in the UK stock market are expected to receive £3.6bn less in dividend payments than anticipated, as companies divert money to address the sharp rise in their pension deficits'. Consultants JLT Group (2017, p. 9) highlight a 'conflict of interest between employers and trustees', and present tables that 'capture employers' reluctance towards contributing to their pension scheme against their relative enthusiasm for declaring dividends'. Analysis by the regulator of the affordability of contributions includes extensive comparisons with dividends (Pensions Regulator, 2016, 2017). The threat to dividends is confirmed by two UK studies which report a strong negative relation between pension contribution and dividend (Bunn and Trivedi, 2005; Liu and Tonks, 2013), supported to an extent by Bunn, Mizen and Smietanka (2018).

Deficit-reduction contributions (DRCs) are certainly a cost to companies, and they have to be funded somehow. However our results differ from the popular perception that DRCs cause reductions in dividends, and from the results of previous UK studies. We find little evidence that DRCs give rise to reductions or omissions in dividend per share (DPS), in the absence of other sufficient reasons. Regression results using the methods in previous studies show no statistically significant relation between dividend or payout and DRC. Analysis of how DRCs are funded reveals that large DRCs tend to be paid in years when companies have healthy cash flows and profits, which helps them avoid having to cut DPS. The results indicate that companies have flexibility regarding when they pay large DRCs.

Our sample of DRCs is from 2003-16. Annual reports since 2003 include for the first time both the cash contribution by the company and service cost (present value of additional pension benefits accrued during the year). This enables us to estimate DRC as contribution minus service cost. The sample period also largely post-dates the UK Pensions Act 2004, which was designed to ensure that DB schemes are adequately funded, and which established a new pensions regulator.

Our empirical strategy has three elements. First, we forecast DPS and total payout per share using the Lintner (1956) model. If DRCs are financed by diverting funds from dividends, we expect actual DPS and payout per share to undershoot their forecasts by increasing amounts, as DRC increases. Second, we follow the existing literature by using regression methods to estimate the effect of DRCs on payout. Third, we examine how DRCs are funded.

Using Lintner-model forecasts, there is a statistically significant effect of large DRCs on DPS, and a larger effect on payout per share. The effect on DPS arises partly because the proportion of companies which cut or omit DPS is higher when DRC is large (top quartile). But the proportion is also high of companies with another reason, such as a loss, that can explain a cut or omission. Most cuts and omissions in years with a large DRC would have been made for other reasons. Our evidence is consistent with the bulk of other evidence on dividend policy, which indicates that DPS is usually cut when profit falls, not when there is a large cash expenditure (such as a DRC). When we exclude firm-years with a cut or omission, around half of the average shortfall remains of DPS in relation to its Lintner forecast, for firm-years with a large DRC. This evidence suggests that large DRCs are associated with restraint in increasing DPS. However, using regression models to explain payout, estimated via OLS, Tobit and GMM, we find no significant relation between dividend or total payout and DRC. Thus the relation between dividend and DRC is sensitive to the model of how dividend is determined, and is not robust.

We go on to analyse how DRCs are funded. The main result is that large DRCs tend to be paid in years with large cash flows from operations, and with high profitability. This result helps explain why few large DRCs are associated with a cut in DPS in the absence of another reason for the cut, and why DRCs give rise to restraint in increasing dividend.[3] The results show in addition a robust positive relation between DRC and disposals, and a negative relation between DRC and share repurchases. We infer that companies are often able to time their pension contributions, such that they are made in years in which they have large cash inflows and profits, and large disposals.

The discretion that companies appear to have regarding timing of DRCs implies that they should not be viewed as cash flow shocks over which companies have little control. The UK regulatory regime, at least since 2004, appears to be more flexible than might be expected. Our evidence is consistent with policy information from the Pensions Regulator that regulation is mostly advisory rather than prescriptive, and that guidance it provides to scheme trustees takes account of the financial health and investment plans of companies. The regulator does not engage with most schemes; when it does so, it negotiates the scheme's recovery plan with the trustees and sponsor (Pensions Regulator, 2014). Intervention to enforce payment of an imposed contribution is a last resort.

Our evidence contributes to research on the impact of pension contributions on company behaviour, challenging the view that DRCs are exogenous impositions that force companies to cut dividends. The paper extends existing evidence by using data on cash contributions that are only reported since 2003, by using Lintner forecasts of DPS and payout per share, and by studying total payout as well as regular dividend. It also adds to the evidence on how pension contributions are funded and determined (Bartram, 2017, 2018).

The results reinforce existing evidence that smoothing of regular dividends is a high priority for managers. One explanation for smoothing is that shareholders of widely held companies prefer smoothed dividends to control agency costs, and that companies respond

[3] Suppose a company with a large increase in EPS pays a slightly higher DPS, and a large DRC. The Lintner forecast error is likely to be negative, because EPS is one of the two variables that determine forecast DPS.

accordingly, as discussed for example in Leary and Michaely (2011) and Michaely and Roberts (2012). In Lambrecht and Myers (2012), managers choose to smooth the rents they pay themselves in order to maximise their lifetime utility. Payout per year has to move in lockstep with managers' rent, otherwise shareholders will either intervene, or receive more rent than is needed to avoid intervention. So smoothing of rents results in smoothing of payouts. In Acharya and Lambrecht (2015), payout smoothing is due to asymmetric information about profit. Shareholders' estimates of profit, on which the payouts they require are based, are less volatile than actual profits, which shareholders are assumed to observe with measurement error. The lack of sensitivity we find of dividends to contributions is perhaps more consistent with the rent-smoothing explanation in Lambrecht and Myers (2012), which does not invoke information asymmetry. There is substantial disclosure of pension expense and contributions during our sample period.

2. Background

2.1 DB schemes and regulation

Adoption of DB schemes was widespread by the 1970s, especially in the public sector and among large companies. However by the 1990s closure of schemes was under way, gathering pace in the 2000s (see Sutcliffe, 2016, pp. 48-62). A fundamental reason for closures is that DB schemes have turned out to be more expensive to employers than expected. Many schemes moved into deficit, obliging employers to pay in extra contributions to reduce the deficits. Reasons for deficits included low stock-market returns in the 2000s, previous contribution holidays by some employers, and rising life expectancy and very low interest rates in the 2010s, both of which increased the present value of pension obligations. In addition, pension expense increased because the expected returns on fund assets fell in the 2010s, partly due to a sustained shift in asset allocation away from equity.

Scheme deficits and dissatisfaction with pension governance and accounting prompted a wave of regulatory reform. This included the Pensions Acts of 1995 and 2004, and Financial Reporting Standard (FRS) 17 (2000) and International Accounting Standard (IAS) 19 (2001). The new accounting standards introduced greater disclosure about pension schemes, and required the volatile DB pension-fund surplus or deficit to be recognised on the balance sheet. This was a key change, which recognised the economic integration between a company and its DB scheme, but almost certainly accelerated scheme closures.

The Pensions Act 2004 was designed to provide better protection for DB scheme members, together with regulation that was responsive to the circumstances of individual schemes and their sponsors. The Act established the Pensions Regulator, with new powers to intervene, including the power to enforce payment of contributions. It also established the Pensions Protection Fund (PPF) to provide insurance in cases of schemes with a failed sponsor. An objective of the regulator is to reduce risks to the PPF. The 1995 and 2004 Acts contain provisions intended to prevent a sponsor from 'walking away' from a scheme in deficit. Under certain circumstances, including an application to the PPF, the deficit becomes a debt of the sponsor.

The 2004 Act abolished the Minimum Funding Requirement, introduced in 1995 but criticised in the government-commissioned Myners Report (2001) for being too mechanical and 'distorting investment patterns without ensuring effective protection for members' (paragraph 8.62). From 2004 the normal process is for scheme trustees (not the regulator) to agree contributions with sponsors. Engagement by the regulator is focused on schemes with severe deficits or where the employer's ability to support the scheme is in doubt. A scheme-specific recovery plan is negotiated, involving payment of minimum contributions, over an agreed number of years, that are expected to be sufficient to eliminate the deficit. The sponsor has some discretion about how much it contributes in any given year, and recovery plans are reviewed over time. Guidance to trustees aims to balance a scheme's need for funding with the amounts of contribution a company sponsor can afford, given its growth and investment plans. Concern for the sponsor helps protect the employer 'covenant' that supports the scheme. Also the government did not intend to hasten the closure of DB schemes by making them unduly onerous.[4]

The demise of DB schemes is widely viewed as damaging to the interests of employees. The norm is now to offer only a defined-contribution (DC) scheme, under which the employer provides a specific level of contribution rather than benefit. The shift to DC transfers risk from the employer to the employee, who is typically less able to understand and manage that risk. To date the shift has been accompanied by greatly reduced contributions, and therefore lower future pensions.[5]

Similar trends of underfunding and closure of DB schemes apply in other developed countries. Private-sector DB schemes had a funding deficit on average in almost all countries by the 2000s (Bartram, 2016, 2017). UK schemes are relatively large, measured by the present value of pension obligations divided by company assets, and they have relatively large deficits. Hence, the UK is a promising setting in which to study how the demands of DB schemes affect the behaviour of company sponsors.

2.2 Previous research

Pension contributions. Several papers examine the impact of contributions on company behaviour. Rauh (2006) regresses capital expenditure (capex) and dividend on mandatory contribution for US firms. He finds a large and statistically significant negative relation

[4] But see Harrison et al. (2005) for views from practitioners that the 2004 Act did make closure more likely. See CIMA (2008), Pensions Regulator (2014), and Thurley (2008, 2017) for more detail on regulation after 2004.
[5] The average contribution rate for private-sector DB (DC) schemes in 2016 was 22.7% (4.2%) of pensionable earnings, split 5.8% (1.0%) from members and 16.9% (3.2%) from employers (Office for National Statistics, 2017).

between capex and contribution, and a negative relation between dividend and mandatory contribution, though it is significant only in Tobit specifications. Rauh's argument that the relation is causal is based on the presence of discontinuities in the function by which a scheme's funding status determines the firm's mandatory contributions.

However, Bakke and Whited (2012) question Rauh's identification strategy. They argue that his research design does not ensure that all endogeneity between contributions and investment opportunities is eliminated. They show that his results are due to a small subset of companies which have severely underfunded pension schemes and high mandatory contributions, and which also face more financial constraint than other sample companies. Financial constraint could cause both underfunding of the scheme and relatively low capex. They find no evidence for an effect of contribution on either capex or dividend using a regression discontinuity design, though they do find that firms with funding level just below a given threshold have lower accounts receivable and higher cash flow, compared with firms just above the threshold. Bakke and Whited suggest that firms fund increases in mandatory contribution by managing receivables to release cash.

For the UK, Bunn and Trivedi (2005) estimate the relations between capex and regular dividend, and pension contribution. Their contribution variable is the pension cost shown in company accounts up to 2003, which was a smoothed version of the cash contribution. They find that dividend is negatively related to pension cost, significant at the 5% or 10% level. Capex is also negatively related to pension cost, but the relation is barely significant.

Liu and Tonks (2013) conduct a similar study, for the period 2002-07. The UK regulatory regime for contributions does not have strict funding thresholds, in contrast to the US regime. But Liu and Tonks argue that the Pensions Act 2004 implies that henceforth 'mandatory pension contributions are exogenous and cannot be manipulated by managers' (p.

236).[6] In regressions estimated by GMM, with regular dividend as the dependent variable, contribution is mostly significant at the 5% level or better, though not consistently so. While Bunn and Trivedi find that one pound of pension contribution is associated with a fall in dividend of 16 pence, the impact in Liu and Tonks is an order of magnitude higher, at £1.30 (or more). They conclude that there is a 'strong and negative relation between pension contributions and corporate dividend payments' (p. 237). A contemporaneous study by Bunn, Mizen and Smietanka (2018) uses data from the regulator (not publicly available) and confirms a negative relation between dividend and DRC, though it is only marginally significant.

We also note the literature which explores links in the other direction, i.e. how a company affects its pension scheme, as opposed to how the scheme affects the company. Of most relevance is the recent evidence of Bartram (2017, 2018) on the determinants of pension contributions in the USA and internationally. He finds that characteristics of the scheme, such as funding status, are the most important determinants, but that the financial health of the sponsor also matters. The size of contributions is related to the sponsor's cash flow (also reported for the USA by Ballester, Fried and Livnat, 2002), capex, cash holdings, leverage and *Z*-score, in the directions expected *a priori*. This evidence implies that firms have some discretion over the timing and amounts of their contributions.[7]

Cuts in dividends. Given most existing research on dividend policy, a large impact of contributions on dividends would be quite surprising. Reluctance of listed firms to cut their regular dividends is an established stylised fact. The most common reason for a cut in DPS is that the firm has made a loss, or suffered a large fall in operating profit (DeAngelo, DeAngelo and Skinner, 1992; Lie, 2005; Bulan, 2010. For the UK, Benito and Young, 2003; Michaely

[6] Similarly, Kiosse and Peasnell (2009, p. 257), reviewing whether accounting changes explain DB closures, remark that 'the major drawback of DB schemes nowadays is that they expose the employer to volatile demands for cash injections'.

[7] Discretion on the part of sponsors is assumed by theories about how a company determines its amounts of contribution, and the funding level it prefers. See Sutcliffe (2016, pp. 221-39) and Bartram (2018).

and Roberts, 2012). We expect it to be unusual for a UK firm to cut DPS in response to a large cash expenditure (such as a DRC), if the expenditure is not accompanied by substantially lower profit.[8]

3. Pension costs and sample

3.1 Reporting of pension expense and contribution

Our sample period is 2003-16. We start in 2003 because this was the first full year in which pension disclosure was governed by Financial Reporting Standard 17, which replaced Statement of Standard Accounting Practice 24.[9] The pension note to the accounts contains much more information than before and includes for the first time the (unsmoothed) cash contribution to the pension fund, and the service cost. These data items enable a more precise estimate to be made of DRCs than was previously possible. Other major changes in reporting were recognition of the scheme surplus (deficit) as an asset (liability) on the balance sheet, and inclusion of the actuarial gain or loss for the year in the statement of recognised income and expense.

Contributions are cash outflows that differ from the pension expense that is charged to operating profit. The reported pension expense of a DB scheme for a given year is:

$$\textit{Pension expense} = \textit{Service cost} + (\textit{Interest cost} - \textit{Expected gain on scheme assets}) \tag{1}$$

where *Service cost* is the present value of the additional benefits accrued by active (non-retired) scheme members during the year,[10] *Interest cost* is the increase in the present value of the

[8] Our data support the expectation of few dividend cuts in response to negative cash flow (measured before dividends, repurchases and financing) without lower profit. There are 214 firm-years where (i) $DPS_{t-1} > 0$, so a cut is possible, (ii) $EPS_t > EPS_{t-1} > 0$, but (iii) $Cashflow_t/Assets_{t-1} < -5\%$. DPS is cut or omitted in only 6.1% of these cases. Even setting $Cashflow_t/Assets_{t-1} < -20\%$, DPS is cut in only 8.0% of cases.

[9] Companies could report using both SSAP 24 and FRS 17 side-by-side, until 2005.

[10] The contribution from employees is part of staff costs, not the company's contribution. It is treated as creating benefits, of the same value as the contribution, that are not part of service cost.

scheme's obligations due to discounting over a period that is one year shorter, and *Expected gain on scheme assets* is the assumed expected return on the scheme's assets times their value at the start of the year. The contribution rather than pension expense is charged against taxable profit (HMRC, 2015), and this provides an incentive to pay contributions in years when they can be fully set against taxable profits.

The relation between pension expense and cash contribution can be explained as follows (Accounting Standards Board, 2000, Appendix 1 is helpful). Consider a scheme in a stable state; it is fully funded, and the interest cost and expected gain on scheme assets are approximately equal. Service cost will be positive if the scheme is open to any future accrual of benefits, and zero if it is fully closed, i.e. closed to new members and frozen to existing members, so that no additional benefits accrue. We would expect the sponsor to make an annual contribution roughly equal to the service cost, if any, to maintain full funding of the scheme. Note that cash payments of pension benefits reduce both assets and liabilities equally.

If the scheme falls into deficit in a given year, this implies one or more of the following: (i) there has been an increase in expected obligations, beyond the increase reflected in service cost, e.g. because of increasing longevity, (ii) the discount rate on expected obligations has been reduced, or (iii) the actual gain on the scheme's assets has been lower than the expected gain. (i) and (ii) imply an increase in interest cost; (iii) might imply a reduction in the assumed expected gain on assets. Thus, a growing deficit implies a growing pension expense, through higher interest cost or lower expected return on assets. The sponsor of a scheme in deficit is likely to start making contributions that exceed service cost, in order to reduce the deficit. But there is no direct accounting relation between pension expense and contribution, and in practice their values can be quite different. For example, BT Group plc for 2016 reported service cost of £301m, interest cost of £1,627m and expected gain on assets of £1,406m, giving a pension expense of £522m. The cash contribution was £1,106m.

We view the portion of a contribution that exceeds service cost as a payment made in order to reduce a scheme deficit. It is the deficit-reducing component (if any) that is potentially a cash flow shock for the company:

$$DRC = Contribution - Service\ cost \tag{2}$$

DRC can be negative under this definition. Any contributions made after full closure of a scheme are entirely DRCs.

3.2 Sample

Our sample consists of operating companies with a DB scheme in the FTSE All-Share index. This includes all large and medium-sized UK companies listed on the London Stock Exchange.[11] The number of operating companies in the index is 555 in 2003, falling to 417 in 2016. Of these, 476 have a DB scheme in 2003, and 321 in 2016, including firm-years in which the DB scheme is fully closed but the company remains the sponsor. We exclude financial companies, and companies that do not report contribution data or have missing dividend or repurchase data. Our final sample consists of 342 companies in 2003, falling to 239 in 2016.

Pension and accounting data are from Worldscope, except for contribution (not provided) and service cost (often missing). These data are available from Bloomberg for 61% of sample companies in 2003, decreasing in later years (Bloomberg often records service cost after a scheme closes as not available rather than zero). We hand-collect missing contribution and service-cost data from annual reports. The contribution and other pension data are consolidated amounts in cases where the company has more than one scheme, and the consolidation includes schemes of overseas subsidiaries (confirmed for Worldscope and Bloomberg data by checks in annual reports).

[11] Most foreign-registered companies listed on the LSE are not in the index because their shares are traded by means of Global Depository Receipts, which are not eligible. About 6% of our sample are foreign-registered but have their shares listed, and therefore qualify. Most are registered in Jersey, Ireland or Bermuda. We view these as UK companies which are registered abroad for tax reasons. The results are unaffected if they are excluded.

Table 1 around here

Table 1 shows annual summary data on scheme characteristics. The Appendix contains definitions of all variables. Overall, the problem of pension deficits eases a little during the sample period. Ninety-four per cent of schemes are in deficit in 2003, falling slightly to 83% by 2016. The average scheme deficit increases in money terms, but declines as a proportion of assets, from 9.8% to 5.4%. We scale throughout by the firm's assets as at the end of its previous financial year, $Assets_{t-1}$, in order to avoid potential inflation of scaled DRC if a large DRC reduces $Assets_t$ (Rauh, 2006, likewise scales by $Assets_{t-1}$). Average $Service\ cost_t/Assets_{t-1}$ declines sharply, from 1.0% to 0.3%, reflecting scheme closures. Average $DRC_t/Assets_{t-1}$ increases from 0.1% in 2003 to between 0.7% and 1.0%. The maximum DRC is 31.7% and the minimum is –15.7%.[12] The average contribution (= service cost + DRC) increases from £25m to £56m in money terms, but as a proportion of assets the peak is 1.8% in 2007, with a decline thereafter to 1.0% in 2016. The annual medians (not shown) exhibit similar trends but are smaller than the means, especially in money terms, because of skewed distributions. For the whole sample period, the mean (median) pension deficit is £167m (£22m) or 6.5% (3.6%) of $Assets_{t-1}$. The mean contribution is 1.3% (0.8%), and DRC is 0.7% (0.3%).

4. Dividends and forecast dividends

4.1 Forecasts from the Lintner model

[12] We made many checks of large DRCs. The resulting changes are as follows. (i) Delete one firm-year, Melrose Industries plc, 2005. This firm-year has extreme values for several variables, including DRC of 43.8%. The company made a huge acquisition during the year in relation to its existing size. (ii) Count a very large DRC by Uniq plc as made in 2007, when the cash was paid into a restricted account, rather than 2010 when the cash was released into the pension fund. (iii) Correct DRCs for BT Group plc, severely understated in Bloomberg for several years. (iv) Correct a huge error in service cost for Morgan Advanced Material plc, 2005.

The Lintner (1956) model is widely used by researchers as a model for how DPS is determined, and we use it to forecast a company's DPS. The model is:

$$DPS_t = aT(EPS_t) + (1 - a)DPS_{t-1}$$

or $$\Delta DPS_t = DPS_t - DPS_{t-1} = aT(EPS_t) - aDPS_{t-1} \quad (3)$$

where DPS_t = regular DPS, EPS_t = earnings (net income) per share, T = target payout ratio and a = speed of adjustment to target. We follow Fama and Babiak (1968) and Leary and Michaely (LM, 2011) in estimating the model on a per-share basis, in the belief that managers focus on DPS rather than the amount of dividend. We estimate T and a in two ways. First, T is estimated by $-\beta_1/\beta_2$, and a by $-\beta_2$ in the following firm-specific time-series regression:

$$\Delta DPS_t = \alpha + \beta_1 EPS_t + \beta_2 DPS_{t-1} + e_t \quad (4)$$

We call (4) the standard method of estimating T and a. Forecast DPS_t is

$$\widehat{DPS_t} = \max[\beta_1(EPS_t) + (1 + \beta_2)DPS_{t-1}, 0] \quad (5)$$

Fama and Babiak (1968) investigate alternative specifications and find that none provides materially more accurate forecasts. More recent studies that use the standard method to forecast DPS include Grullon and Michaely (2002) and Daniel, Denis and Naveen (2008).

LM (2011) show by simulation that there is a serious small-sample bias in estimates from the regression in (4) that use ten or fewer observations, as in our case. When true speed of adjustment (a) is low, estimated speed of adjustment ($-\beta_2$) is overstated. We follow LM and estimate target payout ratio as the firm's median payout ratio (τ) over time, and speed of adjustment by β in

$$\Delta DPS_t = \alpha + \beta(Deviation_t) + e_t \quad (5)$$

where $Deviation_t = \tau(EPS_t) - DPS_{t-1}$. We call (5) the LM method.

For each firm-year we calculate

$$Forecast\ error_t = [DPS_t - \widehat{DPS_t}]/Assets\ per\ share_{t-1} \quad (7)$$

with $\widehat{DPS_t}$ estimated by each of the two methods. The root mean squared forecast error from (7) is 1.57% using the standard method and 1.23% using the LM method, thus we confirm that the latter improves the forecasting accuracy of the Linter model.

Though the Lintner model was developed to explain regular dividends, Skinner (2008) and LM (2011) find that the estimates of β_1 and β_2 are larger and more statistically significant for total payout than for regular dividend, using US data from recent decades. Andres et al. (2015) report similar results for Germany. These authors infer that the Lintner model now explains total payout better than regular dividend. Given the success of the model in explaining total payout, we also use it to estimate forecasts of total payout. In equations (4) to (7), DPS is replaced by payout per share, the sum of regular and special DPS, and repurchases per share.

4.2 Dividend data

Amounts of regular and special DPS declared are from the London Share Price Database (LSPD). We use LSPD because checks against annual reports show that LSPD is more reliable than Worldscope, especially for special dividends. The regular DPS for a financial year is the sum of the interim and final dividend declared, rather than paid, except in the analysis using cash flows in Section 5.4. DPS declared is preferable for our purpose, as it measures more accurately any response to a DRC in a given financial year. In particular, if a company pays a large DRC and cuts its final dividend in the same year, the effect of the cut is seen in the same year using dividend declared. Repurchase data are from Worldscope (LSPD does not include repurchases). We adjust all per-share data for capital actions (see Appendix).

From 1996 some companies choose to pay special dividends by means of a B-share scheme or a court-approved capital reduction.[13] There are 59 cases for our sample companies,

[13] Under a B-share scheme, a company issues redeemable shares pro rata to existing shareholders, and buys them back shortly afterwards. Under a capital reduction, shareholders receive shares in a new company that owns the existing group, plus a cash payment. These schemes are special dividends rather than repurchases, because each

with a total paid out of £32.7bn. LSPD does not have a comprehensive record of payouts via these methods, and Worldscope classifies some of them as repurchases. We identify them by means of word searches (‘B-share’, ‘capital reduction’, ‘return of capital’) of Regulatory News Service announcements, followed by checks in annual reports. We record each payout as the amount declared, for the financial year that gives rise to the declaration, as for a normal special dividend. We remove it if necessary from the repurchase data.

Table 2 around here

Table 2 shows summary statistics for regular DPS and total payout per share. Using EPS as the denominator, the mean (median) payout ratio is 66% (45%) for regular dividend, and 90% (54%) for total payout. Using assets per share as the denominator, the payout ratio is 2.9% (2.5%) for dividend, and 4.1% (2.8%) for payout. The proportion of companies that do not pay a regular dividend is 11% in both 2003 and 2016 (not shown), so there is no tendency during the sample period for the proportion of non-payers to increase.

5. Results

5.1 DRCs and forecast dividends

Table 3 around here

Section 5.1 presents results on the relation between dividend forecast error and DRC. If companies reduce dividend or payout in order to help fund DRC, we expect forecast error to

of the company’s ordinary shares is entitled to the same cash payout. The schemes enable the payout to be taxed as capital gain rather than income. See Oswald and Young (2008) for the schemes’ early years.

be negatively related to $DRC_t/Assets_{t-1}$. Special dividends and repurchases are known to be more flexible than regular dividends, so we expect total payout to be more sensitive to DRC. It is easier for a company paying a large DRC to decline to pay a special dividend or make a repurchase, than to cut regular DPS.

Table 3 presents mean forecast errors by quartile and sub-quartile of $DRC_t/Assets_{t-1}$. Forecast errors are winsorised at the 1st and 99th percentiles. The results using either method of estimation are qualitatively similar; we focus on the LM forecasts because they are more accurate. For DPS, the mean forecast error is positive but close to zero for the first three quartiles, i.e. observed DPS exceeds the forecast. Quartile 4 (Q4), with the largest DRCs, has a minimum DRC of 0.94% and a mean of 2.52%. The mean forecast error for Q4 is –0.31%, which is significantly different from zero at the 1% level, and from the mean error for Q1. However, this shortfall is small in relation to forecast DPS. The mean forecast for Q4 is 3.49% ($DPS_t/Assets\ per\ share_{t-1}$ of 3.18% plus the forecast error of 0.31%), so the mean DPS shortfall is 0.31%/3.49% = 8.9% of the mean forecast.

Table 3 also shows results for sub-quartiles within quartile 4. The largest negative errors are concentrated in firm-years with the largest DRCs. Q4.4 has a minimum DRC of 2.66% and a mean of 5.18%. The mean forecast error is –0.78%, significantly different from zero at the 1% level. This shortfall is 17.9% of the mean forecast. The shortfalls for Q4.3 and Q4.2 are much smaller, and less significant. While Q4.4 has the most negative forecast error, it also has a high mean for $DPS_t/Assets\ per\ share_{t-1}$ of 3.57%, which exceeds the mean dividend/assets ratio for any other quartile or sub-quartile.

The results for total payout per share show more impact of DRC on total payout than on regular dividend, as expected. The mean LM error in Q4 is –1.20%, compared with –0.31% for DPS, and this shortfall is 20.3% of the forecast total payout. There is a strong progression of mean error within Q4, as for DPS. The shortfall for Q4.4 is large at –2.70%, significant at the 1% level, and represents 31.9% of forecast payout. Yet mean $Payout_t/Assets_{t-1}$ for Q4.4 is 5.76%, the highest for any quartile or sub-quartile. So despite the payout shortfall in Q4.4, high DRC is associated with high actual total payout on average, as for DPS.

Median forecast errors are not shown to conserve space, but they confirm the point that only the largest DRCs have an impact. For both regular DPS and total payout, only the negative medians for Q4.4 are significantly different from zero (at the 5% level).[14]

Overall, there is evidence of a small negative impact of DRC on DPS compared with its forecast. This is mostly confined to large DRCs, in Q4.4, in which the mean DRC is 5.2% of assets. For total payout, the mean forecast errors in Q4.1 to Q4.4 are more negative than for DPS, but only the shortfall in Q4.4 is significant at the 1% level.

The evidence in Tables 1 to 3 does not require any accounting data apart from net income and assets. We are therefore able to produce these tables for a FTSE All-Share sample that includes financial companies (but not investment vehicles). This increases the total number of firm-years by nearly 17%. We can confirm that all the evidence for the larger sample is similar to that reported above.

5.2 DRCs and dividend cuts

This section examines whether large DRCs are associated specifically with DPS cuts or omissions, after allowing for instances that can be explained by reasons other than a large DRC. Sufficient reasons for a cut include (i) the firm has made a loss or (ii) suffered a large decline in profit (DeAngelo et al., 1992), or (iii) opted for a more flexible payout for dividends and poor profits (Skinner, 2008), or (iv) sold a large part of its business. The latter is clearly a reason for cutting DPS, because the group's profit-generating base is lower. If any of (i) to (iv)

[14] We also calculate forecast errors using a 'sticky dividend' forecast of no change in DPS, or total payout, as in Daniel et al. (2008). The mean forecast errors using this method are positive and significantly different from zero for all quartiles and sub-quartiles. They show no significant relation with DRC.

apply, the primary reason for the dividend cut or omission is unlikely to be a DRC. Our proxies for the above reasons are (i) EPS is negative in year $t - 1$ or t, (ii) EPS falls by more than 50% in year t, (iii) DPS is cut in year t but total payout per share exceeds DPS in year $t - 1$, or DPS in both year $t - 1$ and t is zero but payout exceeds 3% of $Assets_{t-1}$ in year t, and (iv) the firm makes a disposal of at least 30% of $Assets_{t-1}$ in year $t - 1$ or t. If a DRC is a reason for a dividend cut or omission, we expect the proportion of firm-years with a cut or omission *not* explained by (i) to (iv), and therefore potentially explained by a DRC, to be positively related to DRC. Our sample is firms with an LM forecast, to exclude firms that never pay a dividend, and to assess the impact of excluding cuts and omissions on forecast errors.

Tables 4, 5 and 6 around here

Table 4 shows that in Q1 and Q2 combined, the proportion of firm-years with a cut or omission in DPS is 16.0%, of which the cut or omission is not explained by reasons (i) to (iv) in 19.7% of cases. DRC is either positive or clearly too small to be the reason in these cases, so there is a residue of almost 20% of cuts and omissions that are unexplained even when DRC has no role. The proportion of firm-years with a cut or omission increases somewhat with DRC, rising to 22.0% in Q4 and 25.2% in Q4.4. But there is no sign that DRC on its own has a role in explaining the higher proportion of cuts and omissions in Q4, except in Q4.4. The unexplained proportion in Q4 is slightly lower than in Q1+2, and there is no clear trend within Q4. For Q4.4, the unexplained proportion is 29.7%, 10 percentage points above Q1+2 and 15.4 points above Q4.1. This suggests the existence of a few cases in which a large DRC is the primary reason for a cut or omission (the sample of all cuts and omissions in Q4.4 is only 37 firm-years). A further point is that the proportion of cuts and omissions explained by disposals is higher in Q4 at 9.2%, compared with 2.2% for Q1+2. Some of the disposals by companies with high DRC might have been made in order to pay the DRC.[15]

The results in Table 4 indicate that one of the reasons for the negative forecast errors in Q4 in Table 3 is indeed a higher proportion of firm-years with reduced or zero DPS than in the other quartiles. However, high DRC is *not* the primary reason for most cuts and omissions, even when DRC large. Most companies that pay a high DRC, and cut or omit their dividend, have a sufficient identifiable reason for doing so that is other than the large DRC.

We also investigate the relation between dividend cuts and DRC using logit regressions, where the dependent variable = 1 if DPS is reduced or zero, and zero otherwise. The explanatory variables include DRC and dummy variables representing reasons (i) to (iv) above for reduced or zero dividend. One specification also includes $Net\ income_t/Assets_{t-1}$ and $\Delta Net\ income_t/Assets_{t-1}$, following the studies of dividend cuts by DeAngelo et al. (1992) and Goergen, Correia da Silva and Renneboog (2005). The results are in Table 5. DRC is marginally significant, at the 10% level, or at the 5% level when net income and change in net income are included as control variables. All the control variables except the disposals dummy have the signs expected and are highly significant. The results are similar for the full sample (not shown), instead of the sample with an LM forecast, except that DRC is not significant in any specification. The results in Table 5 confirm that DRC is not on its own an important reason for a dividend cut, but they suggest that DRC has some explanatory power controlling for profitability.

The above evidence implies that some of the impact of DRC on DPS detected in Table 3 is spurious. However DRCs might have an effect independent of cuts and omissions if they cause restraint to DPS increases. In Table 6 we examine this possibility by excluding cuts and

[15] We run multivariate regressions with forecast error as the dependent variable, as in Grullon and Michaely (2002). DRC is significant at the 5% level (forecasts from LM method), or not significant (forecasts from standard method). We do not report these regressions as there is a clear endogeneity problem: profitability affects both forecasts and return on assets, a control variable.

omissions, and re-examining forecast error by DRC (sub-)quartile. The mean LM error for Q4 is 0.05%, compared with 0.30% for Q1, and the difference significant at the 1% level. The mean error for Q4.4 is –0.20%. These differences suggest restraint in increasing DPS, in relation to Lintner-model forecast DPS, when companies pay large DRCs. Possible restraint in increasing DPS accounts for 0.22 percentage points of the 0.41 point difference between Q1 and Q4 in Table 3, and for 0.40 points of the 0.89 point difference between Q1 and Q4.4.[16]

5.3 Regression analysis

Tables 7 and 8 around here

We go on to provide further estimates of the impact of DRC on payout, by means of regressions using panel data, following the methods of previous papers reviewed in Section 2.2. Table 7 shows results for regressions with variables and specifications similar to those in Rauh (2006, Table 4), except that our contribution variable is DRC rather than mandatory contribution:

$$\begin{aligned} Div_{it}/Assets_{i,t-1} = {} & \beta_1 DRC_{it}/Assets_{i,t-1} + \beta_2 Q_{i,t-1} + \beta_3 NonpenCF_{it}/Assets_{i,t-1} \\ & + \beta_4 Funding_{it}/Assets_{i,t-1} + \alpha_i + \alpha_t + e_{it} \qquad (8) \end{aligned}$$

where Div_{it} is regular dividend declared by firm i, $Q_{i,t-1}$ is Tobin's Q as at the end of year $t-1$, $NonpenCF_{it}$ is the firm's cash flow from operations plus pension contribution, $Funding_{it}$ is pension-fund assets minus liabilities, and α_i and α_t are firm and year fixed effects, respectively. All variables are winsorised at the 1st and 99th percentiles. Since dividend and payout have a floor of zero, we estimate equation (8) using Tobit and industry fixed effects, as well as by

[16] Average forecast error due to firm-years with no cut or omission = Av(Error)N_{nocut}/N, where N the total number of firm-years in the quartile.

OLS. If DRC reduces payout, the coefficient on DRC should be negative. We expect the coefficients on *NonpenCF* and *Funding* to be positive: companies with higher cash flow are likely to pay higher dividends; *Funding* is likely to be positively related to the sponsor's profitability (Bartram, 2018), and more profitable companies pay higher dividends. The expected sign on *Q* is uncertain. *Q* could serve as another proxy for profitability, in which case its sign should be positive, or *Q* could proxy for investment opportunities and demand for capital expenditure, in which case its sign could be negative. The coefficients on *Q* are positive and significant in Rauh (2006).

The key result is that the coefficient on DRC is negative but not statistically significant using either OLS or Tobit.[17] We discuss this below, after the results for GMM regressions. *NonpenCF* and *Funding* have a positive sign, as expected. *NonpenCF* is highly significant, and *Funding* is significant at the 5% level using Tobit.[18] *Q* also turns out to be positive and highly significant. The results are similar with total payout as the dependent variable, with no significant relation between payout and DRC (surprisingly the sign on DRC is positive). Both *Q* and *Cashflow* have larger and more significant coefficients than with dividend as the dependent variable, consistent with total payout being more responsive than regular dividend to profitability (e.g. Skinner, 2008).

The model in (8) is mis-specified in that it omits the previous year's dividend, which we know to be strongly related to the current year's dividend because dividends are smoothed over time. In a model with a lagged dependent variable and firm fixed effects, OLS produces biased estimates of the lag coefficient. This stems from the de-meaning when controlling for

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[17] We report significance using standard errors corrected for heteroscedasticity and clustered by firm. DRC is significant at the 5% level under both OLS and Tobit using standard errors without these corrections. Controlling for clustering of errors by firm has heightened importance under a Tobit specification, because use of firm fixed effects is not possible. To the extent that the firm fixed effect remains in the residual, ignoring autocorrelation at the firm level materially understates the standard errors.

[18] Bunn et al. (2018) note that companies face exogenous shocks to DB funding status. For example, lower gilt yields imply a higher present value of pension liabilities. They interpret the positive relation between funding and dividend as evidence that companies respond to deficits by paying lower dividends. An alternative view is that funding and dividend are expected to be related through being correlated with profitability.

firm fixed effects, whereby any shock to the dependent variable affects both the de-meaned lagged dependent variable and the de-meaned error term. To alleviate this problem, researchers often use the two-step system GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998) (see also Wintocki, Linck and Netter, 2012). This approach uses first differences to control for fixed effects while simultaneously instrumenting for differenced lags of the dependent variable using both deeper lags of variable levels as well as lags of the differences themselves. The approach is applied by Bunn and Trivedi (2005) and Liu and Tonks (2013). Following these authors, the GMM regressions we estimate are[19]

$$\begin{aligned} Div_{it}/Assets_{i,t-1} = {} & \beta_1 Div_{it-1}/Assets_{i,t-2} + \beta_2 DRC_{it}/Assets_{i,t-1} + \beta_3 Q_{i,t-1} + \\ & \beta_4 NonpenCF_{it}/Assets_{i,t-1} + \beta_5 Funding_{it}/Assets_{i,t-1} + \\ & \beta_6 Debt_{it}/Assets_{i,t-1} + \beta_7 Capex_{it}/Assets_{i,t-1} + \alpha_i + \alpha_t + e_{it} \end{aligned} \tag{9}$$

All explanatory variables with the exception of the year dummies are treated as potentially endogenous and are instrumented using GMM-style instruments, as explained above, from lag-length 3 to lag-length 4. Year dummies are considered strictly exogenous. Instrument lags are collapsed in order to avoid proliferation of weak instruments. We also calculate results with two lags of the dependent variable included on the right-hand side. The dependent variable lagged twice is not significant, so we do not report these results.

To ensure robust application of the system GMM method, we examine four diagnostic tests. First, we expect by construction significant negative first-order autocorrelation in the errors, owing to the first differencing inherent in the GMM approach. There should not be significant second-order autocorrelation, if the model is properly specified. We implement a Hansen test of overidentifying restrictions under the null that all instruments are valid. Finally, we run difference-in-Hansen tests of exogeneity, under the null that instruments used for the

[19] Our regressions include the same set of explanatory variables, but they are not identical. Bunn and Trivedi scale dividends and pension cost by sales rather than assets, and Liu and Tonks scale all their variables by $Assets_t$ rather than $Assets_{t-1}$. In addition, contribution and some of the control variables are measured differently.

equations in levels are exogenous. All the test statistics are in the range for us to conclude that our models are appropriately specified and that the instruments have sufficient strength and exogeneity.

Table 8 shows the results of the GMM regressions. The lagged value of dividend has a large coefficient of 0.83 that is highly significant, as expected. Serial correlation of the dependent variable is lower for total payout, as expected given that it includes special dividends and repurchases which are more variable over time than regular dividends. DRC is not significant and has a positive sign (not expected) with payout as the dependent variable. The lack of explanatory power for DRC is consistent with the OLS and Tobit regression results in Table 7. The control variables have the signs expected, though some are not significant.

The results using Lintner-model forecasts show some effect of DRC on payout, whereas the regression results do not. This inconsistency could arise because of a fundamental difference between the two approaches. The Lintner approach involves estimates of coefficients on EPS and lagged DPS that are specific to each firm. Regression uses data on all firms together, and estimates single representative relations between payout and DRC, profit and the other explanatory variables, that are the same across all firms.

The GMM results for the impact of DRC on dividend differ from those in Bunn and Trivedi (2005) and Liu and Tonks (2013). Both papers report coefficients on their contribution variables that are significant at the 5% level, or sometimes better in Liu and Tonks. Comparison of our results with those in Bunn and Trivedi suggests that the impact of pension contributions on dividends might have become *less* following the Pensions Act 2004. The Pensions Regulator could in practice have enabled firms to negotiate more easily, with regard to the timing of contributions, than was the case before 2004 under the Minimum Funding Requirement. We also note that GMM results are rather sensitive to the specification of the regression, as discussed for example by Baum (2013). The coefficients are large in Liu and Tonks, ranging between –1.3 and –11.8. Their low-end estimates imply that 'the effect of a £1 increase in total PCs [pension contributions] is to reduce dividends by between £1.32 and £1.52' (p. 256). This seems *a priori* to be an extraordinarily large impact, and it is an order of magnitude larger than Bunn and Trivedi estimate.

Bunn et al. (2018) use non-public data from the Pensions Regulator on recovery plans, including DRCs which they describe as mandatory, though they note that companies have discretion regarding the timing of DRCs (their note 13). Their sample period is 2011-15. They estimate the impact of DRC on dividend via Tobit regressions similar to those reported in the last two columns of Table 7. Their DRC variable has a negative coefficient significant at the 10% level (their Table 4, column 4). The significance of DRC is marginal and could be due to how they calculate standard errors. We find that, in regression model (7) estimated using Tobit, DRC becomes significant at the 5% level without controlling for clustering of errors by firm. But we believe it is correct to control for clustering of errors by firm (note 17).

Results for capex. Tables 7 and 8 include results with capex as the dependent variable. Using OLS regression, DRC has a coefficient of –0.14, significant at the 5% level. This is consistent with US evidence, though the relation is weaker. Using GMM, and including one lag of $Capex_t/Assets_{t-1}$ in the right-hand side, the coefficient on DRC is negative but not close to significance. The negative sign on *Funding* is unexpected. Neither Bunn and Trivedi (2005) nor Liu and Tonks (2013) find a robust and significant negative relation between capex and pension cost or DRC, using GMM. Our results are therefore similar to theirs with respect to company investment. But Bunn et al. (2018) using GMM do find a significant negative relation between capex and DRC.

5.4 Funding of DRCs

The above results indicate that few DRCs are funded by reducing regular dividend or total payout, and the relation with capex is weak. This raises the question of how companies actually fund their large contributions. To help provide an answer, we regress DRC on components of cash flow. It could be that higher DRCs are paid in years with higher cash flow, or when the company raises external debt or equity. Bakke and Whited (2012) suggest that US companies fund increased contributions by managing working capital.

The net cash flow to be financed in a given firm-year can be analysed as:

$$NetCF = NonpenCF - DRC - Capex - Acq - \Delta Workingcap + Disposal - Divpaid + OtherCF \qquad (10)$$

where *OtherCF* is all other cash flows and *Divpaid* is regular dividends paid rather than declared (other variables are defined in the Appendix). *NetCF* must be equal to the change in cash holdings, plus change in debt, plus cash raised from share issues, net of any flexible payouts via special dividends and repurchases:

$$NetCF = \Delta Cash - (\Delta Debt + Share\ issue - Specialdivpaid - Repurchase) \qquad (11)$$

A positive value for Δ*Debt* or *Share issue* means cash is raised from lenders or investors, respectively. The relations between DRC and the components of cash flow and financing will help reveal how companies tend to fund DRC.

Table 9 around here

Table 9 shows the results of regressions with firm fixed effects, in which the dependent variable is $DRC_t/Assets_{t-1}$. In models 1 and 2 the explanatory variables are components of cash flow or variants: dividends declared instead of paid; net income instead of cash flow. *NonpenCF*, with a positive sign, is highly significant and easily has the most explanatory power. Most of the other variables also turn out to be significant at the 5% level or more, signed as would be expected *a priori*: *Capex* (–), *Acq* (–), Δ*Workingcap* (–), *Disposal* (+), *Divpaid* (–), Δ*Cash* (–), Δ*Debt* (+), *Share issue* (+), and *Repurchase* (–).[20] The results using dividends as declared instead of as paid are almost identical. The results suggest that, controlling for other variables, companies tend to fund large DRCs by reducing capex, expenditure on acquisitions, and regular dividends, avoiding repurchases, raising equity and debt, using cash holdings and proceeds from disposals, and reducing working capital. It appears that companies fund DRCs by a variety of means.

The results change somewhat when *Net income* is used instead of *NonpenCF* (models 3 and 4). *Net income* itself is statistically significant but has less explanatory power than *NonpenCF*, and of the other variables only *Disposal* and *Repurchase* remain significant. These results suggest that *Capex*, *Acq*, Δ*Workingcap*, *Divpaid*, Δ*Cash*, Δ*Debt*, and *Share issue* have explanatory power for DRC only conditional on operating cash flow (gross of contribution).

Model 5 adds four pension-related variables, namely funding status and pension liabilities scaled by $Assets_{t–1}$, and the expected and actual returns on fund assets. This is closer to a full model to explain what determines DRCs. Unfortunately the sample is smaller due to missing data in Worldscope. The new variables have the signs expected; funding status and liabilities are significant at the 5% level, and actual returns on fund assets is significant at the 10% level. The additional variables do not make much difference to the results for the cash flow variables.

Regarding payouts, *Divpaid* and *Div* have a negative coefficient which is significant at the 5% level controlling for *NonpenCF*. But the results indicate that several other variables are more important in explaining how DRCs are funded. The coefficient on *Specialdivpaid* is positive but not significant, whereas the coefficient on *Repurchase* is negative and significant

[20] The role of disposals in funding DRCs is probably understated, because of a timing problem. Cash received in year *t* from a disposal can be used to fund a large DRC in year *t* + 1. Alternatively, a large DRC in year *t* can be made in anticipation of receiving cash in *t* + 1.

at the 1% level. So we find that large DRCs are associated with lower repurchases but not lower special dividends, controlling for cash flow. The result for dividends and repurchases are consistent with the evidence from Lintner forecasts of some effect of DRC on DPS, with the effect on total payout per share being greater.

The regressions do not show the direction of causality between DRC and the explanatory variables, and the direction is likely to differ depending on the variable. Companies have limited control over *NonpenCF*, so it seems more plausible that a company with a high operating inflow chooses to make a high DRC, than that a high DRC causes the company to have a high operating cash flow. That is, cash flow is largely exogenous with respect to DRC, so it is a potential determinant of DRC. Companies have much more control over *Repurchase* and Δ*Cash*. So it is more plausible that a high DRC can cause a company to spend less on repurchases, or to use some of its cash holdings, than that a low repurchase or reduction in cash causes the company to pay a large DRC. We also see that DRC is associated with *Disposal*, Δ*Debt* and *Share issue*. In these cases the causality is ambiguous. For example, a company might take the opportunity of an inflow from a large disposal to pay a large DRC, or the company might have made the disposal to fund the DRC.

The evidence supports an inference that companies have some choice over when to pay large contributions. Recovery plans agreed with the regulator afford companies time to raise funds, or to wait for years with large inflows. The results are mostly consistent with Bartram (2017), who studies the determinants of pension contributions using a large international sample. He finds that contributions are positively related to cash flow and negatively related to capex, which is consistent with our results. He interprets this as (part of the) evidence that DB schemes provide sponsoring firms with financial flexibility, in terms of remuneration of staff. Bartram (2018) conducts a similar analysis for a US sample, but using a much larger number of explanatory variables, most of which are not cash flow variables. He concludes that ‘pension plan characteristics have, by far, the largest explanatory power' (p. 19). Surprisingly, gross profit margin is barely significant and capex is not significant – but cash flow is not included as an explanatory variable in his regression, and our results are sensitive to its inclusion.

We note finally that though DRC has a modest impact on current regular dividend or payout, a company's use of funds for DRCs from operating cash flows and other sources implies that it will have less cash in future than it would otherwise have. This makes it possible that payouts to shareholders will be lower in future than they would otherwise have been.

As an important robustness test, we run all the above analyses (Tables 3 to 9) using total cash contribution instead of DRC. All the results are very similar, and are not reported (they are available on request).

6. Conclusion

The paper investigates the relation between pension contributions and payouts to shareholders in companies listed on the FTSE All-Share index during 2003-16. We find that, contrary to expectations, there has been little impact of contributions on regular dividend. The impact we detect, using firm-specific Linter-model forecasts of DPS or total payout per share, is confined to firm-years with unusually large DRCs. Much of the impact is in the form of restraint in increasing DPS or in making repurchases. The incidence of cuts and omissions in DPS, that are not explicable by poor profit or another sufficient reason, is little higher in firm-years with large DRCs. In addition, the evidence for a detectable impact of DRCs is not robust. There is no impact measured by means of regressions with dividend or payout scaled by assets as the dependent variable. The evidence confirms that pension contributions are not an exception to the rule, inferred from much previous research on dividends, that companies cut dividends in response to poor profit rather than to cash outflows.

Our analysis of how DRCs are funded offers an explanation for why we find little relation between DRC and DPS. Firm-years with large DRCs have larger operating cash flows (before pension contribution, capex and payout) and higher net income, compared with other firm-years. We infer that companies are able to time when they make large contributions, so that most are made in years with healthy cash flows and profits. This enables companies to avoid cuts in DPS. Another possible benefit from timing is that it helps in saving corporation tax, given that contributions are set against taxable profits. Our evidence is consistent with Bartram (2017), who reports a significant positive relation between contribution and cash flow, for an international sample, in regressions to explain contribution.

This evidence implies that companies with pension deficits are normally given some discretion about when and how much they contribute, and that contributions are less of an exogenous shock imposed by the Pensions Regulator, and more of an expenditure that the company can manage. This is consistent with statements of policy. In cases where the regulator gets involved in the setting of contributions, it takes a scheme-specific and long-term view on deficit recovery, working with firms to help secure pension benefits alongside other corporate policy aims.

The closure of DB schemes in the UK over the last 20 years has been justified primarily by concern about the scale of pension deficits and the resulting contributions, including perceived threats to dividends. Our evidence suggests that some of this concern is misplaced. Companies with deficits have been able make increased contributions without much disruption to payouts to shareholders.

Appendix: definitions of variables

In all cases the variable relates to a firm-year. Numbers in brackets are Worldscope data codes, where applicable. Adjustment for capital actions: LSPD's daily capital-actions file records for each company an adjustment factor for each scrip issue, share consolidation, and scrip element in a rights issue. We multiply the adjustment factors over time to obtain a cumulative adjustment factor for any given day. Each regular and special DPS declared is recorded unadjusted by LSPD.

Variable	**Definition**
Acq	*Cash cost of acquisitions net of cash balances acquired (04355)*
Actualrtn	*Actual return for year on pension-fund assets (18816)*
Assets	*Total assets (02999)*
Assets per share	*Total assets/common shares outstanding at financial year-end (05301) adjusted for capital actions*
Capex	*Capital expenditure (04601 plus 04651)*
Cash	*Cash holdings (02001)*
Contribution	*Cash contribution from company to its pension fund*
Debt	*Total debt outstanding (03051 + 03251 + 18282)*
Deficit	*Pension-fund deficit: Fair (market) value of pension assets (18807) minus Penliabs; a surplus is a negative number*
Disposal	*Proceeds from sale of fixed assets (04351)*
Div	*Regular dividend declared: sum of interim and final DPS times number of shares as at month of declaration*
Divpaid	*Regular dividend paid: sum of DPS payments where each payment is multiplied by number of shares as at month of DPS declaration*
DPS	*Regular dividend declared per share: sum of interim and final DPS adjusted for capital actions up to start of month of each declaration*
DRC	*Deficit-reduction contribution: Contribution – Service cost*
Expectedrtn	*Expected long-term return on pension-fund assets (18805)*

Variable	Definition
EPS	*Earnings (net income) per share (05201) adjusted for capital actions up to financial year-end*
Funding	*Fair (market) value of pension assets (18807) minus projected benefit obligation (18809)*
Net income	*Net income (profits after tax) available to common stockholders (01751))*
NonpenCF	*Cash flow from operations (04201) plus Contribution*
Payout	*Total payout declared: Div plus special DPS declared times number of shares as at month of declaration plus Repurchase*
Payout per share	*DPS plus special dividend declared per share adjusted for capital actions up to start of month of declaration, plus Repurchase divided by adjusted number of shares as at financial year-end; includes payouts under special schemes*
Penliabs	*Pension-fund liabilities: projected benefit obligation (18809), i.e. reported present value of future obligations*
Q	*(Assets plus market value of equity (08002) minus shareholder equity (03501))/Assets*
Repurchase	*Cash spent on stock purchased or redeemed (04751). We subtract any reduction in preference shares outstanding in the relevant year, and exclude payouts under special schemes: if repurchase recorded > 1.1 × special payout, we subtract the payout and treat the remainder as a repurchase; if repurchase < 0.9 × payout, we leave the amount as it is; otherwise we treat the repurchase as misclassified and set it to zero.*
Sales	*Net sales or revenues (01001)*
Service cost	*Current service cost of pension fund (18811); present value of additional benefits accrued by active scheme members. We do not include any 'past service cost' or other adjustments to service cost for relevant year (which are therefore included in DRC).*
Share issue	*Proceeds from issue of common and preferred stock net of costs of issue (04251)*
Specialdiv	*Special dividend declared: special DPS declared times number of shares at start of month of declaration; includes payouts under special schemes*
Specialdivpaid	*Special dividend paid: special DPS paid times number of shares at start of month of declaration; includes payouts under special schemes*
Workingcap	*Accounts receivable (02051) plus inventories (02101) minus accounts payable (03040)*

Table 1
Pension data by sample year

The sample consists of non-financial operating companies in the FTSE All-Share index which sponsor a DB pension scheme and have requisite data available. Definitions of variables in all tables are in the Appendix. *N* = number of companies per year. The figures shown are equally weighted means, except for *N* and proportion of schemes in deficit. Sources: Worldscope, Bloomberg and annual reports. If companies do not report in sterling, we convert their data to sterling at the year-end exchange rate.

Year	*N*	Schemes in deficit	Deficit £m	$Deficit_t/Assets_{t-1}$	Contri-bution £m	$Contrib_t/Assets_{t-1}$	Service cost £m	$Service\ cost_t/Assets_{t-1}$	DRC £m	$DRC_t/Assets_{t-1}$
2003	342	94.2%	157	9.76%	25	1.10%	17	1.00%	8	0.10%
2004	336	94.1%	140	8.15%	29	1.31%	18	0.90%	11	0.41%
2005	332	95.5%	155	8.87%	30	1.45%	20	0.86%	10	0.59%
2006	322	89.8%	74	6.94%	39	1.70%	23	0.86%	16	0.84%
2007	298	80.9%	–3	3.52%	41	1.83%	22	0.80%	19	1.04%
2008	292	78.8%	103	3.99%	36	1.43%	23	0.64%	12	0.79%
2009	288	93.4%	181	8.01%	61	1.27%	20	0.45%	41	0.83%
2010	278	92.8%	184	6.98%	51	1.18%	21	0.37%	30	0.81%
2011	263	85.2%	187	5.71%	53	1.29%	24	0.37%	29	0.92%
2012	256	87.9%	230	6.14%	64	1.36%	24	0.34%	39	1.02%
2013	257	82.9%	215	4.96%	55	1.14%	27	0.31%	28	0.83%
2014	252	83.7%	274	5.59%	47	1.24%	28	0.29%	19	0.95%
2015	245	79.2%	224	4.36%	50	1.00%	31	0.31%	19	0.70%
2016	239	82.9%	303	5.42%	56	1.01%	32	0.30%	24	0.71%

Table 1 cont.

Full sample	Deficit £m	$Deficit_t$/ $Assets_{t-1}$	Contri-bution £m	$Contrib_t$/ $Assets_{t-1}$	Service cost £m	*Service* $cost_t$/ $Assets_{t-1}$	DRC £m	DRC_t/ $Assets_{t-1}$
Mean	167	6.46%	44	1.32%	23	0.59%	21	0.74%
Minimum	–6,302	–75.34%	0	0.00%	0	0.00%	–338	–15.73%
25th percentile	4	0.72%	1	0.30%	0	0.08%	0	0.02%
Median	22	3.60%	5	0.77%	2	0.30%	2	0.30%
75th percentile	92	8.77%	23	1.63%	11	0.75%	10	0.91%
Maximum	10,400	531.42%	3,343	35.65%	1,207	23.40%	2,761	31.73%
Number of firm-years	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000

Table 2
Payout ratios: summary statistics

Payout as a proportion of earnings (net income) and assets. Firm-years with negative net income are excluded. Sources: LSPD for regular and special dividends, Worldscope for repurchases, net income per share and assets.

	Payout per share$_t$/EPS$_t$		*Payout per share$_t$/Assets per share$_{t-1}$*	
	Regular dividend	Total payout	Regular dividend	Total payout
Mean	65.8%	89.5%	2.9%	4.1%
Minimum	0.0%	0.0%	0.0%	0.0%
25th percentile	28.5%	34.0%	1.3%	1.5%
Median	44.7%	53.9%	2.5%	2.8%
75th percentile	65.2%	84.3%	3.9%	4.8%
Maximum	797.0%	1,126.7%	11.5%	29.5%
N	3,486	3,486	4,000	4,000

Table 3
DPS and payout forecast errors by size of DRC

Mean values of forecast errors for DPS and payout per share, by quartile and sub-quartile of $DRC_t/Assets_{t-1}$. Forecast error for each firm-year = $DPS_t - \widehat{DPS}_t$, where $\widehat{DPS}_t$ is from the Lintner model with firm-specific coefficients estimated by the standard method (eq. 4) or the Leary-Michaely (LM) method (eq. 5). The estimation period for the coefficients is 1991-02; we require at least eight consecutive years of data, and at least one year to have non-zero payout. Forecasts are for the years 2003-16. DPS and forecast error are scaled by *Assets per share*$_{t-1}$. The sample using the LM method is smaller because an LM forecast requires an average payout ratio across the eight years, so cannot be calculated if there is a loss. *N* is the number of firm-years per DRC category. Scaled errors are winsorised at the 1st and 99th percentiles. ***(**)(*) = different from zero at the 1% (5%) (10%) level of significance.

	Coefficients in Lintner model estimated by									
	Standard method					Leary-Michaely method				
Quartile	DRC	DPS	Forecast error	Significance	*N*	DRC	DPS	Forecast error	Significance	*N*
PANEL A: REGULAR DIVIDEND PER SHARE										
1	–0.23%	3.10%	–0.09%		611	–0.20%	3.20%	0.11%	**	591
2	0.18%	2.81%	0.10%	*	610	0.17%	2.76%	0.07%	*	590
3	0.62%	3.13%	–0.08%		610	0.60%	3.13%	0.02%		591
4	2.52%	3.10%	–0.39%	***	610	2.47%	3.18%	–0.31%	***	591
1 – 4			0.30%	**				0.41%	***	
4.1	1.13%	2.93%	–0.05%		153	1.10%	3.00%	–0.01%		148
4.2	1.54%	2.93%	–0.23%	**	152	1.50%	3.03%	–0.19%	*	148
4.3	2.18%	3.12%	–0.21%		153	2.13%	3.14%	–0.25%	**	148
4.4	5.24%	3.44%	–1.08%	***	152	5.18%	3.57%	–0.78%	***	147
4.1 – 4.4			1.03%	***				0.77%	***	
PANEL B: TOTAL PAYOUT PER SHARE										
1	–0.23%	4.66%	–0.14%		611	–0.20%	4.88%	0.29%		591
2	0.18%	3.69%	–0.42%	**	610	0.17%	3.62%	–0.22%		590
3	0.62%	4.40%	–0.10%		610	0.60%	4.42%	–0.27%		591
4	2.52%	4.47%	–1.25%	***	610	2.48%	4.71%	–1.20%	***	591
1 – 4			1.11%	***				1.49%	***	
4.1	1.13%	3.86%	–0.96%	**	153	1.10%	3.88%	–0.33%		148
4.2	1.54%	4.20%	–0.78%		152	1.51%	4.42%	–0.61%		148
4.3	2.18%	4.84%	–1.54%	**	153	2.13%	4.79%	–1.18%	*	148
4.4	5.24%	4.98%	–1.72%	**	152	5.18%	5.76%	–2.70%	***	147
4.1 – 4.4			0.76%					2.37%	***	

Table 4
Reasons for cuts or omissions in DPS, by size of DRC

Columns 1 to 4: proportions of firm-years in which each of four reasons for a cut or omission in regular DPS apply, by category of $DRC_t/Assets_{t-1}$. Column 5: proportion of firm-years with a cut or omission. Columns 6 to 9: proportions in which each reason for a cut applies, out of firm-years with DPS cut or zero. Column 10: proportion where the cut or omission is not explained by at least one of the reasons, and so could be due to a DRC. The four reasons for a cut or omission are (i) loss in year $t-1$ or t, (ii) $EPS_t < 0.5EPS_{t-1}$, (iii) DPS is cut in year t but $Payout\ per\ share_t > DPS_{t-1}$, or $DPS_{t-1} = DPS_t = 0$ but $Payout_t > 3\%$ of $Assets_{t-1}$, (iv) disposal of at least 30% of $Assets_{t-1}$ in year $t-1$ or t. A firm-year can have more than one reason for a cut or omission. The sample consists of firm-years with a forecast error using the Leary-Michaely method. ***(**)(*) = proportions differ at the 1% (5%) (10%) level of significance.

	Proportion of firm-years with:						Of firm-years with DPS cut or zero, proportion with:					
Quartile by *DRC*/ $Assets_{t-1}$	1 Loss %	2 Fall in profit %	3 Flexi payout %	4 Disp -osal %	5 DPS cut or zero %	*N*	6 Loss %	7 Fall in profit %	8 Flexi payout %	9 Disp -osal %	10 Due to DRC? %	*N*
1 + 2	18.9	7.0	2.8	1.3	16.0	1,181	61.8	10.7	17.3	2.2	19.7	189
3	21.2	6.8	3.6	0.9	18.6	591	61.8	8.2	19.1	0.9	19.1	110
4	21.3	5.8	4.9	2.7	22.0	591	56.2	8.5	22.3	9.2	19.2	130
4 – (1+2)	*2.4*	*–1.7*	*2.1 ***	*1.4 **	*6.0 ****		*–5.6 ***	*–2.2*	*5.0 ***	*7.0 ****	*–0.5*	
Within fourth quartile												
4.1	23.0	3.4	5.4	0	17.6	148	65.4	3.9	30.8	0	15.4	26
4.2	21.6	6.8	6.1	3.4	22.3	148	51.5	12.1	27.3	12.2	12.2	33
4.3	22.3	8.1	3.4	1.4	23.0	148	61.8	11.8	14.7	5.9	17.7	34
4.4	18.4	4.8	4.8	6.1	25.2	147	48.7	5.4	18.9	16.2	29.7	37
4.4 – 4.1	*–4.6*	*–2.8*	*–0.6*	*6.1 ****	*7.6*		*–16.7 ****	*1.6*	*–11.9 ***	*16.2 ****	*14.4 ****	

Table 5
Logit regressions to explain dividend cuts and omissions

The dependent variable is 1 if $DPS_t < DPS_{t-1}$ or if $DPS_t = 0$, and 0 otherwise. *Loss dummy* = 1 if EPS is negative in year t–1 or t; *Profitability-fall dummy* = 1 if $EPS_t < 0.5EPS_{t-1}$; *Disposal dummy* = 1 if firm makes a disposal of at least 30% of $Assets_{t-1}$ in year t – 1 or t; *Flexi-payout dummy* = 1 if DPS is cut in year t but $Payout\ per\ share_t > DPS_{t-1}$, or $DPS_{t-1} = DPS_t = 0$ but $Payout_t >$ 3% of $Assets_{t-1}$. The sample consists of firm-years with a forecast error using the Leary-Michaely method. Each continuous variable is winsorised at the 1st and 99th percentile. Standard errors clustered by firm are in parentheses. ***(**)(*) = different from zero at the 1% (5%) (10%) level of significance.

	1	2	3
$DRC_t/Assets_{t-1}$	8.011*	7.693*	13.744**
	(4.252)	(4.204)	(6.049)
Loss dummy		2.727***	1.2235***
		(0.205)	(0.226)
Profitability-fall dummy		1.286***	0.870***
		(0.225)	(0.225)
Flexi-payout dummy		1.374***	1.433***
		(0.337)	(0.342)
Disposal dummy		0.614	0.722
		(0.438)	(0.508)
$Net\ income_t/Assets_{t-1}$			–15.837***
			(0.955)
$\Delta Net\ income_t/Assets_{t-1}$			6.455***
			(1.142)
Year fixed effects	Yes	Yes	Yes
N	2,363	2,362	2,362
Pseudo R^2	0.039	0.257	0.309

Table 6
DPS forecast errors excluding cuts and omissions

Mean forecast errors for DPS, excluding firm-years with reduced or zero DPS, by DRC quartile and sub-quartile. The sample before exclusions consists of firm-years with a forecast error using the Leary-Michaely method. Different sample numbers in the categories arise because of different numbers of firm-years excluded. Scaled errors are winsorised at the 1st and 99th percentiles. ***(**)(*) = means differ at the 1% (5%) (10%) level of significance.

	Coefficients in Lintner model estimated by		
Quartile by *DRC*/ $Assets_{t-1}$	Standard method %	Leary-Michaely method %	*N*
1	0.09	0.30	501
2	0.34	0.24	491
3	0.14	0.23	481
4	–0.23	0.05	461
4 – 1	*–0.32****	*–0.29****	
Within fourth quartile			
4.1	0.06	0.12	122
4.2	–0.08	0.09	115
4.3	–0.03	0.16	114
4.4	–0.93	–0.20	110
4.4 – 4.1	*–0.99****	*–0.32**	

Table 7
Regressions to explain payout and capex

Results of OLS and Tobit regressions using equation (8). Standard errors are in parentheses, corrected for heteroscedasticity and clustered at the firm level. ***(**)(*) = significant at the 1% (5%) (10%) level.

	OLS	OLS	OLS	Tobit	Tobit
	$Div_t/$ $Assets_{t-1}$	$Payout_t/$ $Assets_{t-1}$	$Capex_t/$ $Assets_{t-1}$	$Div_t/$ $Assets_{t-1}$	$Payout_t/$ $Assets_{t-1}$
$DRC_t/Assets_{t-1}$	–0.0536	0.0381	–0.1442**	–0.0509	0.0849
	(0.035)	(0.105)	(0.069)	(0.058)	(0.115)
Q_{t-1}	0.0083***	0.0132***	0.0088***	0.0114***	0.0177***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
$NonpenCF_t/Assets_{t-1}$	0.1103***	0.1516***	0.1297***	0.1515***	0.2321***
	(0.013)	(0.022)	(0.023)	(0.015)	(0.027)
$Funding_t/Assets_{t-1}$	0.0110	0.0404**	0.0022	0.0205**	0.0723***
	(0.009)	(0.017)	(0.011)	(0.010)	(0.016)
Firm-years	3,867	3,866	3,863	3,867	3,866
Number of firms	441	441	441	441	441
Adjusted R-squared	0.338	0.170	0.151	n.a.	n.a.
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	n.a.	n.a
Industry fixed effects	No	No	No	Yes	Yes

Table 8
GMM regressions to explain payout and capex

Results of two-step system GMM regressions using equation (9). Standard errors are in parentheses, corrected for heteroscedasticity and clustered at the firm level. The AR(1) and AR(2) p-values are for first- and second-order serial correlation of the residuals, respectively. The Hansen test of over-identification is to test that all instruments are valid. The diff-in-Hansen test of exogeneity is to test that the instruments used for equations in levels are exogenous. ***(**)(*) = significant at the 1% (5%) (10%) level.

	Div_t/ $Assets_{t-1}$	$Payout_t$/ $Assets_{t-1}$	$Capex_t$/ $Assets_{t-1}$
Dependent variable$_{t-1}$	0.8304***	0.4455***	0.4520***
	(0.054)	(0.141)	(0.092)
$DRC_t/Assets_{t-1}$	–0.0060	0.2415	–0.1931
	(0.114)	(0.371)	(0.240)
$Capex_t$ /$Assets_{t-1}$	–0.0903*	–0.0695	
	(0.034)	(0.078)	
Q_{t-1}	–0.0029	0.0100*	–0.0009
	(0.002)	(0.006)	(0.004)
$Debt_t/Assets_{t-1}$	–0.0153	–0.0490**	0.0106
	(0.010)	(0.021)	(0.018)
$NonpenCF_t/Assets_{t-1}$	0.0449**	0.0848	0.0538
	(0.019)	(0.053)	(0.058)
$Funding_t/Assets_{t-1}$	0.0219	0.0846**	–0.0493**
	(0.013)	(0.040)	(0.024)
$Sales_t/Assets_{t-1}$			0.0047
			(0.006)
Observations	3,425	3,425	3,423
Number of firms	410	410	409
AR1 p-value	0.000	0.000	0.000
AR2 p-value	0.566	0.149	0.797
Hansen test p-value	0.900	0.468	0.330
Diff-in-Hansen test p-value	0.704	0.558	0.635

Table 9
Regressions to explain funding of DRC

OLS regressions of $DRC/Assets_{t-1}$ on cash flow and other variables. All variables are scaled by $Assets_{t-1}$. They are listed by cash flow (eq. 10) and financing (eq. 11). Model 5 includes variables related to the pension fund. Outflow variables (*DRC*, *Capex*, *Acq*, Δ*Workingcap*, *Divpaid*, Δ*Cash*, *Specialdivpaid*, *Repurchase*) have a positive sign if there is an outflow. All variables are winsorised at the 1st and 99th percentiles. Standard errors in parentheses are corrected for heteroscedasticity and clustered by firm. ***(**)(*) = significant at the 1% (5%) (10%) level.

	1	2	3	4	5
NonpenCF	0.073***	0.071***			0.075***
	(0.010)	(0.010)			(0.014)
Net income			0.015***	0.16***	
			(0.005)	(0.005)	
Capex	–0.042***	–0.038***	–0.008	–0.006	–0.039***
	(0.014)	(0.010)	(0.010)	(0.010)	(0.010)
Acq	–0.014**	–0.015**	–0.003	–0.001	–0.016
	(0.006)	(0.004)	(0.004)	(0.004)	(0.006)
Δ*Workingcap*	–0.013***	–0.014***	–0.003	–0.003	–0.013**
	(0.005)	(0.005)	(0.004)	(0.004)	(0.006)
Disposal	0.040***	0.039***	0.021**	0.019**	0.050***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.015)
Divpaid	–0.052**		0.017		–0.057*
	(0.023)		(0.024)		(0.032)
Div		–0.054**		0.006	
		(0.024)		(0.024)	
Δ*Cash*	–0.020***	–0.020***	–0.004	0.001	–0.019**
	(0.006)	(0.006)	(0.005)	(0.006)	(0.008)
Δ*Debt*	0.016***	0.016***	0.007*	0.006	–0.016***
	(0.04)	(0.004)	(0.003)	(0.003)	(0.005)
Share issue	0.016***	0.015***	0.005	0.004	0.015**
	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)
Specialdivpaid	0.004		0.016		0.010
	(0.016)		(0.016)		(0.027)
Specialdiv		0.019		0.035*	
		(0.020)		(0.019)	
Repurchase	–0.047***	–0.049***	–0.027**	–0.027**	–0.044***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.015)

Table 9 cont.

	1	2	3	4	5
Funding					–0.021**
					(0.010)
Penliabs					0.008**
					(0.004)
Expectedrtn					0.029
					(0.039)
Actualrtn					0.003*
					(0.002)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
N	3,975	3,930	3,975	3,930	2,248
Adjusted R^2	0.13	0.13	0.06	0.06	0.16

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